

REMARKS

The subject invention relates to a metrology instrument optimized to measure grating like microstructures on a semiconductor sample. The instrument includes an illumination source directing light through an objective. The objective focuses the light on the sample. The reflected light is collected and measured. Parameters of the grating structure are derived from the measured light.

In accordance with claim 1, the invention further includes an elongated pupil aperture 107 positioned between the light source and the objective 103. The elongated pupil aperture creates an elongated illumination spot. The orientation of the pupil aperture is selected so that the long direction of the illumination spot is oriented generally transverse to linear elements of the microstructure. By this arrangement, a sufficient number of grating lines are illuminated to obtain good measurement sensitivity while minimizing the illumination of non-grating regions which can degrade measurement performance. Claim 1 has been amended to make explicit that it is the long dimension of the illumination spot which is oriented transverse to the linear elements of the grating structure.

In the Office Action, the Examiner objected to the drawings as failing to disclose the spectrometer of claim 2. The Examiner also rejected claim 2 for its recitation of spectrometer and “reflected intensity spectrum.” Applicants believe that the illustration of detector 106 and its description as a “radiation sensing detector” which is capable of acquiring “reflectivity data...over a range of wavelengths” provides support for original claim 2. However, to simplify the issues, applicants have amended claim 2 to use only the specific verbiage found in the specification as filed. Accordingly, this rejection can be withdrawn.

In the Office Action, the Examiner objected to the drawings in that Figures 1, 2A and 2B should be labeled as prior art. Applicants acquiesce in the Examiner’s request with respect to Figures 2A and 2B. A proposed drawing correction is attached hereto. With respect to Figure 1, although it is referenced in the background section of the patent specification, it is also a representation of the subject invention. This is clear from the brief description of the drawings which states that the drawing of Figure 1 is “a side schematic view of an optical metrology instrument showing those elements that are common to both the prior art and the present invention.” Figure 1 corresponds to the present invention when the aperture 107 is of the type

described in the best mode section of the specification. For this reason, it is believed that Figure 1 should not be labeled as prior art and this objection should be withdrawn.

In the Office Action, the Examiner objected to the use of the phrase “low numerical aperture” in claim 3. Applicants have amended claim 3 to delete this phrase and therefore this rejection should be withdrawn.

In the Office Action, the Examiner rejected the claims as being obvious based on the patent to Haga (6,356,399) in view of de Groot (6,011,624). The Examiner argues that Haga teaches a metrology instrument for samples containing grating-like microstructures. Further, the Examiner argues that Haga teaches an aperture located in the illumination path and an objective lens for focusing the light. The Examiner admits that the Haga reference fails to teach an elongated aperture and relies on the patent to de Groot for such a teaching. Applicants respectfully traverse this rejection.

As described in the background of the subject specification, applicants acknowledge that metrology systems which have an aperture in the illumination path are not new. De Groot demonstrates that apertures generally can have non-circular forms. However, the intent of the subject invention is to use an elongated aperture to create an elongated illumination spot that has a particular orientation with respect to the linear elements of the grating-like structures on the sample. Neither of the cited references even hints at this concept. This is not surprising since neither of the references is at all related to measuring grating-like microstructures. The Examiner has asserted that Haga relates to measuring grating-like microstructures but there is no such teaching in Haga. Since there is no teaching of measuring grating-like microstructures in either reference, there can be no teaching of the subject matter recited in amended claim 1, i.e. that “the long direction of the illumination spot is oriented generally transverse to the linear elements of the microstructure.”

This claimed combination is particularly suited to measuring grating-like microstructures and is not obvious from the cited prior art. Accordingly, it is respectfully submitted that amended independent claim 1 and the claims depending therefore define patentable subject matter and allowance thereof is respectfully requested.

Respectfully submitted,

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Enclosure: Figures 2A and 2B with prior art notation

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